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Research Inquiry Draft

Question: How does improving sleep duration in adolescence affect an individual's body mass index (obesity, etc) in adulthood?

Introduction:

The importance of sleep for health has been mentioned omnipresently, constantly reappearing throughout our daily lives. Moreso, a stress on healthy amounts of sleep is usual as it is paramount to leading a healthy lifestyle. Sleep deprivation, a condition that occurs if you don't get enough sleep, is extremely common among adolescents. According to a 2006 National Sleep Foundation poll, more than 87 percent of high school students in the United States get far less than the recommended eight to ten hours of sleep (Richter). Results from sleep deprivation include but are not limited to hypertension, activation of the sympathetic nervous system, impairment of glucose control, increased inflammation, cardiovascular disease, and variations among an individual's body mass index (Alvarez, Ayas).

BMI is a person's weight in kilograms divided by the square of height in meters. Although BMI does not measure body fat directly, it can be used as a measure to determine if an individual's weight is healthy for their height. An individual's BMI can be categorized within four different categories: underweight, healthy weight, overweight, and obese. Essentially, BMI is an inexpensive and easy-to-perform method of screening an individual's weight category.

Previous research has shown strong evidence that sleep duration is an important factor for adolescent BMI. Although the public health relevance of sleep as an important risk factor for obesity is not uniformly accepted, shorter sleep duration is a risk factor for increased BMI among

adolescent children is clear. However, there is a lack of sufficient studies done on sleep duration and its effect on BMI within different age groups. This paper thus focuses on detecting a potential correlation between duration of sleep in adolescence and BMI in adulthood. Through close examinations on (1) the effect of sleep duration on BMI during adolescence, (2) the effect of sleep duration on BMI during adulthood, and (3) stability of BMI from adolescence to adulthood, an improvement in sleep duration in adolescence will not affect an individual's body mass index in adulthood. In addition, this paper will provide clear limitations to this conclusion, while offering suggestions for a call to action.

The effect of sleep duration on BMI during adolescence:

An accumulating body of previous research indicates a direct association between sleep duration and BMI. In particular, studies consistently reported an association between short sleep duration and a higher risk for excess body weight among adolescents. Cappuccio et al. examined whether short sleep duration (generally defined as < 10 hours per night) was associated with obesity in 30,002 children and adolescents from around the world. Mainly based on cross-sectional studies, the results indicated that short sleep duration was associated with an 89% increased odds of obesity for children/ adolescents. More specifically, a meta-analysis by Chen et al. found that each hour of increased sleep duration was associated with a 9% decreased odds of overweight/obesity. An additional study conducted by Mitchell et al. further differentiate adolescents within separate BMI categories and its impact from variations among sleep durations. About 1390 adolescents were studied (ages 14 to 18) over a four year span, each followed-up every six months. Results found that each additional hour of sleep was associated with decreases in BMI at the 10th percentiles. In particular, association strength was the

strongest at the upper tail of the BMI distribution (obesity). Moreover, a recommendation was made for an increase in duration of sleep among adolescents in the upper half of the BMI distribution, as it may help prevent overweight and obesity. Overall a clear negative correlation between duration of sleep and BMI was found, since lowering sleep duration resulted in an increase in BMI.

The effect of sleep duration on BMI during adulthood:

Likewise, a correlation between sleep duration and BMI is clear among adults. Meyer et al. conducted a study and survey addressing this concern, testing over 2000 individuals. Using an original Project EAT survey, Meyer et al. were about to extract essential information regarding sleeping habits, duration, and quality. Additionally, information regarding BMI categories were based on self-reported height and weight from the participants. Results found that the percentage of overweight and obesity was roughly 15-25% higher among men who slept <7 hours/day than those who slept 7 or more hours/day. However, it is important to recognize that this association was not relevant for women. Instead a clear effect of short sleep duration on BMI may be stronger, or restricted to, males. An additional study done by Hasler et al. found a trend ($p=0.8$) for average change rate of weight gain to be negatively associated with average change rate of sleep duration. Interviewing over 400 young adults, Hasler et al. found that despite controlling for a variety of potential confounding variables, a clear association between short sleep duration and obesity persisted. Similarly to adolescents, a clear negative correlation between duration of sleep and BMI was found, since lowering sleep duration resulted in an increase in BMI.

Stability of BMI from adolescence to adulthood:

The transition between adolescence and adulthood is a developmentally sensitive time where an individual may be at risk for becoming overweight and developing obesity. The potential disturbance to an individual's BMI can be a result of genetic or environmental influences, initiating the study done by Haberstick et al. A total of 1,178 siblings were asked to participate in the National Longitudinal Study on Adolescent Health, allowing the genetic data collection to form a model. Results for the genetic contributions were highly correlated, underscoring the importance of genetic influence on BMI. Instead, longitudinal analyses indicated that the relevant individual-specific environmental influences on BMI made a much greater impact. In other words, stability of BMI from adolescence to adulthood is not fixed but instead varies more depending on environmental factors of an individual.

Conclusions:

Based on close examinations of (1) the effect of sleep duration on BMI during adolescence, (2) the effect of sleep duration on BMI during adulthood, and (3) stability of BMI from adolescence to adulthood, an improvement in sleep duration in adolescence will not affect an individual's body mass index in adulthood. To begin, stability of BMI from adolescence to adulthood is not fixed but instead can vary. Improving one's BMI during adolescence will not guarantee a similar category placement for when the individual is older. Therefore, increasing sleep duration during adolescent years that result in a lower BMI may not sustain the environment influences through the passage of time to adulthood. It is important to note that at the time of this paper, only one paper (to my knowledge) addresses a potential stability of BMI from adolescence to adulthood. Wang et al. concluded that adolescents with a BMI \geq 85th percentile were at elevated risk for obesity in adulthood. These individuals were more likely to

be obese, but this stability is not secure as there is no guarantee. Instead, environmental influences play an additional factor.

Likewise, a potential relationship between age, sleep, and BMI results in a U-shaped graph. Through an evaluation of over 5,000 National Healthy and Nutrition Examination Surveys, Grandner et al. found a changing relationship among age. For young adults, the relationship between sleep and BMI was linear. However this relationship changed for the middle-aged and continued to weaken through older adulthood. This changing relationship concludes that sleep and BMI is directly associated with certain age groups. A potential relationship between two different age groups is weak. Therefore, improving sleep duration in adolescence will most likely have no effect on an individual's body mass index in adulthood, as they both are directly specific to their own age groups.

Additionally, it is also important to note the additional multiple variables that can affect BMI alongside sleep duration. An individual's eating habit will have a direct correlation with their BMI, as frequent consumptions of "beer, alcoholic drinks other than beer and wine, coffee, tea, coke, red meat, variety meat, and eggs" are associated with a significantly higher risk for obesity (Gunes et al.). Alongside, an individual's participation in physical activity can reduce the risk of being overweight and/or obese. Although physical activity alone cannot maintain BMI, it can help reduce the risk (Kesavachandran et al.). Ultimately future research on the correlation between sleep duration and BMI should take into consideration monitoring for outside variables, a clear absence from mention studies.

While this paper concludes no effect of an improvement in sleep duration in adolescence on an individual's body mass index in adulthood, it is important to note the lack of research. This

conclusion was purely generated from three different components of sleep and BMI, as there was no previous research done on this topic (to my knowledge). Further research is essential, as both sleep and BMI play a huge role in our everyday lives. By acknowledging this research limitation, it is also necessary to consider potential contributions we can do. Although the effect of improving sleep duration in adolescence on an individual's body mass index (obesity, etc) in adulthood remains unclear, the importance of sleep isn't. Simply promoting better sleeping styles will help individuals lead a more healthy life, as they are at lower risk for depression, cardiovascular disease, accidents, etc. While we wait for future research to be done on this particular field, we can begin improving on aspects we know work for sure. Then by the time new research is developed, we'll be a step ahead in the game.

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